

A' 14. (Once Amended) The apparatus as claimed in claim 1,
wherein the emitter excitations include energies transported by
carrier diffusion.

32. (Once Amended) The apparatus as claimed in claim 31,
wherein a concentration of cadmium (Cd) is between 20% and 30%.

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A 33. (Once Amended) The apparatus as claimed in claim 1,
wherein a distance from a p-n junction in the p-n junction diode
to the catalytic collector is less than three times a diffusion
length of minority carriers [electrons] in the p-n junction
diode.

34. (Once Amended) The apparatus as claimed in claim 1,
wherein the catalytic collector further includes:

a catalyst,

wherein total path traveled by energetic carriers between a
catalyst surface exposed to adsorbate reactants and a
semiconductor of the excitation emitter is less than three times
the total energy mean free path of the energetic carriers along
the path.

A³ 46. (Once Amended) The apparatus as claimed in claim 1,
wherein the catalytic collector [has] includes a material having
Debye temperature less than 500 degrees Kelvin.

A⁴ 53. (Once Amended) The apparatus as claimed in claim 50,
wherein the electrode underlayer metal has a thickness [such that
total energy mean free path of energetic carriers in the
electrode underlayer metal is] less than three times energy mean
free path of the excitations going through it.

A⁵ 66. (Once Amended) The method of claim 65, wherein the
coupling includes forming a catalytic collector in the adsorbate-
catalyst with one or more quantum confinement surface structures.

A⁶ 68. (Once Amended) The method of claim 65, wherein the
coupling includes forming a catalytic collector in the adsorbate-
catalyst and the optimizing includes [forming] constraining the
thickness of a region between a surface of the catalytic
collector exposed to adsorbate reactants and the excitation
emitter, the region having a thickness of less than three energy
mean free paths of hot carriers exchanged between [electrons of]
the catalytic collector and the excitation emitter.

69. (Once Amended) The method of claim 65, wherein the optimizing includes selecting a substrate with band gap energy less than or equal to a selected excitation in the adsorbate-catalyst [system].

A⁶ 70. (Once Amended) The method of claim 65, wherein the optimizing includes adjusting a forward bias of the diode such that a [conduction] band of excitation energy in the excitation emitter matches [the diode is equal to a selected] a band of excitation energies in the adsorbate-catalyst [system].

A⁷ 78. (Once Amended) The method of claim 72, wherein the method further includes:

modifying one or more electron density of states of a material in a catalytic collector to match a selected range of energy transitions of one or more excitation band structures of an adsorbate-catalyst system having the adsorbate reactants.

A⁸ 102. (Once Amended) A method of stimulating reactions, comprising:

creating hot carriers in an excitation emitter, the excitation emitter in contact with a catalytic collector, by applying power to a diode in the excitation emitter;

transporting the hot carriers originating in the diode into the catalytic collector having catalyst material;

manipulating thickness properties of the catalyst material such that the hot carriers remain hot while they are transported to a surface of the catalytic collector, the surface being exposed to reactants.

110. (Once Amended) The method of claim 102, wherein the reactants have a partial pressure such that not more than one monolayer forms for each of the reactants on a surface of the catalyst material.

142~~151~~. (New) The apparatus as claimed in claim 1, wherein the emitter excitations include energies transported by resonant tunneling.

143~~152~~. (New) The apparatus as claimed in claim 1, wherein the catalytic collector further includes a catalyst, a material of the catalyst and an electrode of the p-n junction diode being one and the same.

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153. (New) The method of claim 70, wherein a hot carrier is an electron and the excitation band of the emitter is its conduction band.

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154. (New) The method of claim 70, wherein a hot carrier is a hole and the excitation band of the emitter is its valence band.

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155. (New) The method of claim 72, wherein the method further includes:

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modifying one or more electron density of states of a material in a catalytic collector to match a selected excitation band structure of an adsorbate-catalyst system having the adsorbate reactants.

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156. (New) The method of claim 78, wherein the modifying includes forming one or more electron interferometer structures to cause a plurality of hole reflections.

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157. (New) A method of stimulating reactions, comprising:
applying power to a diode in an excitation emitter, the excitation emitter being in contact with a catalytic collector;
creating hot carriers in the excitation emitter;

coupling excitation energy of the hot carriers to an excitation band structure of the catalytic collector by using resonant tunneling;

constraining the thickness properties of a coupling material of the catalytic collector such that the resonant tunneling of the excitation energy experiences an energy transfer rate between excitation emitter and catalytic collector not less than 3% of the competing, energy loss rates.

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158. (New) The method of claim ¹⁴⁸157, wherein the constraining the thickness properties includes constraining the thickness to less than 200 nanometre (nm) for a conducting coupling material of the catalytic collector.

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159. (New) The method of claim ¹⁴⁸157, wherein the constraining the thickness properties includes constraining the thickness to less than 100,000 nanometre (nm) for a non-conducting coupling material of the catalytic collector.

REMARKS

This is a preliminary amendment to U.S. Patent Application No. 09/631,463, filed August 3, 2000, which claims the benefit of U.S. Provisional Application No. 60/186,567, filed March 2, 2000.